REMARKS

Entry of this amendment and reconsideration of this application is respectfully requested.

The prior amendments to the specification which were not entered are represented.

Claim 2 is canceled to overcome the objection thereto.

Claims 1 to 4 and 10 were rejected under 35 U.S.C. §103(a) as allegedly obvious over Ikegame in view of Hayakawa. Claims 5-7 and 17 were rejected under 35 U.S.C. §103(a) as allegedly obvious over Ikegama, Hayakawa and either Tachikawa and Makabe. Claims 8-9 were rejected under 35 U.S.C. §103(a) as allegedly obvious over Ikegama in view of Hayakawa and Hirose. Applicants respectfully traverse each of these rejections.

Hayakawa discloses a method of producing a lens holder for an optical pick-up using an injection molding technique wherein the resin is injected into a die through a gate such that the gate is disposed parallel to the inside perimeter of the bearing part.

However, an important object of the present invention is to provide a lens holder with a resin injection molded product comprising <u>a bearing part formed vertically to a lens receiving surface</u>. Hayakawa does not disclose this feature, because a core pin for conventional lens holder mold for injection molding is fixed on the moving template or the fixed template. When the fixed template and the moving template are abutted to close the injection mold, the core pin can be fixed in the cavity to the moving template or the fixed template constrained. (See Fig. 9 and Fig. 10). A small gap is formed between the moving or fixed template and the core pin if the template and the core pin are unconstrained, and the gap causes to generate undesirable burrs in the products. To prevent burr formation, the gap should be minimized.

However, a center axis of the core pin does not conform to a center axis of the bearing hole fixed to the core pin of the mold, and the gap between them is from several μm to several tens of μm, even if a mold is precisely produced. This is because a small gap if formed between the moving template and the fixed template of the mold to prevent galling when the core pin in inserted, and the gap causes minor dislocation between the core pin provided on the moving template and the depression provided on the fixed template.

Due to the dislocation between the center axis of the core pin and the center axis of the bearing hole, even if the dislocation is about 1 µm, the core pin is inserted slantingly into the depression when the mold is closed. Accordingly, the lens holder thus formed has a lens receiving surface and a bearing surface that are not vertical.

As described above, the conventional lens holder, including Hayakawa, cannot provide a bearing surface is formed vertically to the lens receiving surface.

When the lens holder on which the lens receiving surface and the bearing surface are provided, but not vertically, it becomes difficult to fix the objective lens, resulting in low working efficiency and high number of defects.

With the lens holder of the present invention, the core can be held in the cavity when the core pin in the fixed template unconstrained, when the fixed template and the moving template are abutted to close the injection mold. Accordingly, the core pin can be held in the cavity without inclinations and the bearing hole is formed vertically to the lens receiving surface.

Also, as the core pin in the fixed template is held unconstrainedly, the gate for injecting a resin is formed between a core pin for forming a bearing hole and a concave part of a fixed template. Accordingly, undesirable burrs are not generated in the resultant products.

As the core pin in the fixed template is held unconstraindly, the gap, having a circumferential shape, forms a disc gate. Since the gap is the disc gate, and the gate disposes at an end part of a bearing opposite to a lens supporting part, the lens holder has excellent roundness for the bearing surface.

Hayakawa describes a method of producing a lens holder comprising the steps of disposing the center hole into which a center axis is inserted a gate for injecting a resin containing a filler having shape anisotropy, injecting the resin containing the filler from the gate, and directing the filler symmetrically to an axis center of the center axis.

Thus, the recited features of claim 1, including (a) the core pin that can be held in the cavity with the core pin in the fixed template unconstrained, (b) a gate formed between a core pin and a concave part of a fixed template, are not believed to be taught or suggested by Hayakawa.

In view of the foregoing, the aforementioned obviousness rejections based in part on Hayakawa should be withdrawn.

Claims 11-15 were rejected under 35 U.S.C. §103(a) as allegedly obvious over Hirose in view of either Tachikawa or Makabe, and Ikegame. Claim 6 was rejected under 35 U.S.C. §103(a) as allegedly obvious over Hirose in view of either Tachikawa or Makabe and Ikegami. Claims 18-20 were rejected under 35 U.S.C. §103(a) as allegedly obvious over Hirose, Tachikawa or Makabe, and Umetsu. Applicants respectfully traverse each of these rejections.

There are many known types of a optical pick-ups, for example, a supporting shaft type, a wire supporting type, a resin hinge system type and a plate spring type. All optical pick-ups require a high attenuation characteristic, but only the supporting shaft type requires excellent sliding properties. The wire supporting type, the resin hinge system type and the plate spring type do not have sliding parts to be composted by a focusing and tracking servo; therefore, excellent sliding properties with the supporting shaft are not required.

An optical pick-up having a supporting shaft comprises a supporting shaft mounted on a base, and a lens holder rotatably supported on the supporting shaft. The focusing and tracking servo is controlled by a relative motion between the supporting shaft and the lens holder. It is an important technical object to have excellent sliding properties with the supporting shaft and extremely high lens supporting accuracy of bearing. As described above, in sharp contrast to other type of optical pick up, the lens holder of the present invention is required to have much sliding property with the supporting shaft and extremely high lens supporting accuracy of bearing.

The optical pick-up of claim 11 comprises as follows:

(1) a supporting shaft, and a lens holder having a bearing part which fits on said supporting shaft rotatably,

(2) the supporting shaft is formed of ceramics containing zirconia,

(3) the bearing part is a molded product of a liquid crystal resin composition having flexural elastic modulus of 10 GPa or more,

(4) 20 to 85% by weight of an aluminum borate whisker is a mixed based on the total weight of the resin composition

(5) a coefficient of maximum static friction between the lens holder and the bearing is 0.12 or less.

Compared to the cited references, Ikegami discloses element (1), Hirose discloses element (2), and Makabe discloses element (4), respectively. However, the elements (3) and (5) are not shown or suggested in the cited reference.

Makabe discloses a resin composition having improved flexural elastic modulus and metering stability. Also, disclosed is the suggestion that their resin composition can be applied to an optical pick up. However, Makabe does not disclose a resin composition for an optical pick-up having a supporting shaft. Also, Makabe does not disclose a resin composition having excellent sliding property with the supporting shaft. The resin compositions do not to have excellent sliding property and cannot apply to an optical pick up having a supporting shaft. Makabe simply discloses resin composition having a flexural elastic modulus of 10 GPa or more. Makabe does not teach or suggest the optical pick-up having a supporting shaft.

Accordingly, Makabe does not disclose the optical pick-up having element (3), namely the bearing part is a molded product of a liquid crystal resin composition having flexural elastic modulus of 10 GPa or more.

Tachikawa discloses resin compositions having a thermoplastic base resin that is at least one species selected from styrene resin, polycarbonate resin, and polyphenylene ether resin, and 0.5-100 parts by weight of liquid crystalline polymer as component. The liquid crystalline polymer is blended as a binder and the binder is dispersed in a state of powder in the base resin. Accordingly, the liquid crystalline polymers disclosed in Tachikawa are essentially different from the liquid crystalline polymer as a base resin of the present invention. Also, Tachikawa does not disclose resin composition having flexural elastic modules of 10 GPa or more.

Element (5), which relates to a coefficient of maximum static friction between the lens holder and the bearing is 0.12 or less is explained as follows:

Claim 11 claims the optical pick-up having a supporting shaft, and having an excellent coefficient of maximum static friction between the lens holder and the bearing.

Hirose discloses an optical pick-up having a supporting shaft of ceramics containing zirconia, and a lens holder of polyphenylenesulfide resin composition. The coefficient of maximum static friction of Hirose's optical pick-up is disclosed as 0.13-0.16.

The optical pick-up as claimed in claim 11 has 0.12 of coefficient of maximum static friction, which is better than that of Hirose.

These features were obtained by the combination of the lens holder and the ceramics containing zirconia. The lens holder comprises the molded product of a liquid crystal resin composition containing 20 to 85% by weight of an aluminum borate whisker.

Table 1 shows that the coefficient of maximum static friction of Example 7 containing 30% by weight of a carbon fiber and not containing an aluminum borate whisker is the same as that of other examples containing an aluminum borate whisker. However, bearing surfaces have a tendency to deteriorate with accuracy when a liquid crystal resin composition contains carbon fibers. The aluminum borate whisker is better than carbon fibers in technical objects to have excellent sliding properties with optical pick up having a supporting shaft and extremely high accuracy of lens holder. See Examples 11, 14 and 20 in Table 2. The addition of fluororesins to resin composition deteriorates as inside diameter standard deviation of lens holder. (See Example 11). Example 20 however contains 5% by weight of the fluororesins shows better property of an inside diameter standard deviation of lens holder than Example 14 which does not contain fluororesins.

Accordingly (a) Tachikawa disclose a liquid crystal resin composition that is entirely different from that of claim 11; (b) Makabe does not disclose the optical pick-up having a supporting shaft of claim 11; (c) Hirose does not disclose the combination of a supporting shaft formed of ceramics containing zirconia and a molded product of a liquid crystal resin composition.

Makabe does not disclose an optical pick-up having a supporting shaft, and does not consider applying excellent sliding properties with the optical pick up. Therefore, an ordinary person in the art cannot combine the supporting shaft formed of ceramics containing zirconia of

Hirose with the optical pick-up having a supporting shaft of Makabe, as claimed in claim 11. Also, the liquid crystal resin composition disclosed by Makabe, which does not disclose sliding properties, cannot apply to the optical pick-up having a supporting shaft of claim 11.

Makabe, Tachikawa and Hirose do not disclose the optical pick-up comprising a supporting shaft as claimed in claim 11, which comprises (a) a supporting shaft formed of ceramics containing zirconia; (b) a bearing part of a molded product of a liquid crystal resin composition having 20 to 85% by weight of aluminum borate whisker, (c) a coefficient of maximum static friction between said lens holder and said bearing is 0.12 or less. The optical pick-up having higher accuracy of an optical axis for controlling a focus and tracking servo as are obtained by the resin composition as claimed in claim 11.

Accordingly, allowance is respectfully requested.

If any additional fees are due, authorization is given to charge deposit account no. 50-0624.

Respectfully submitted,

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